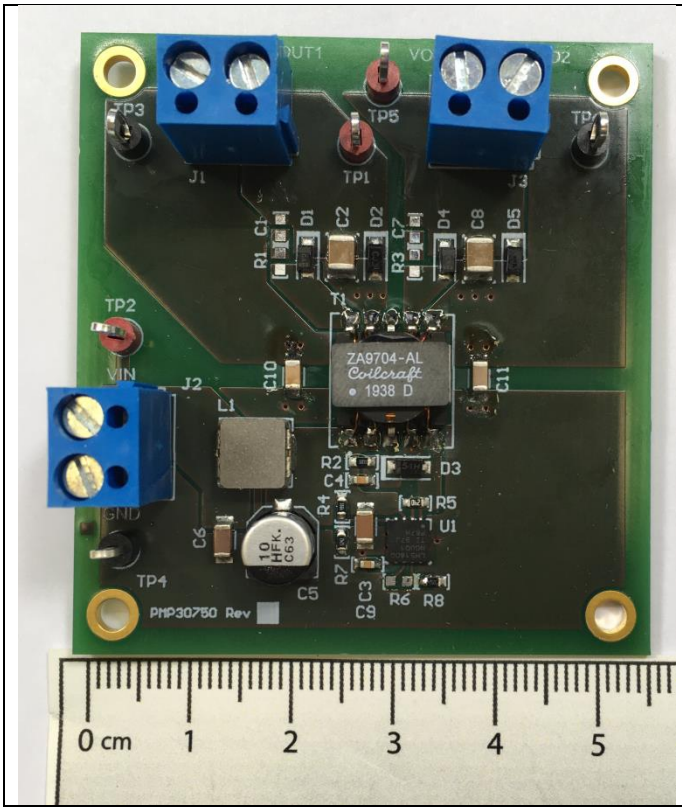
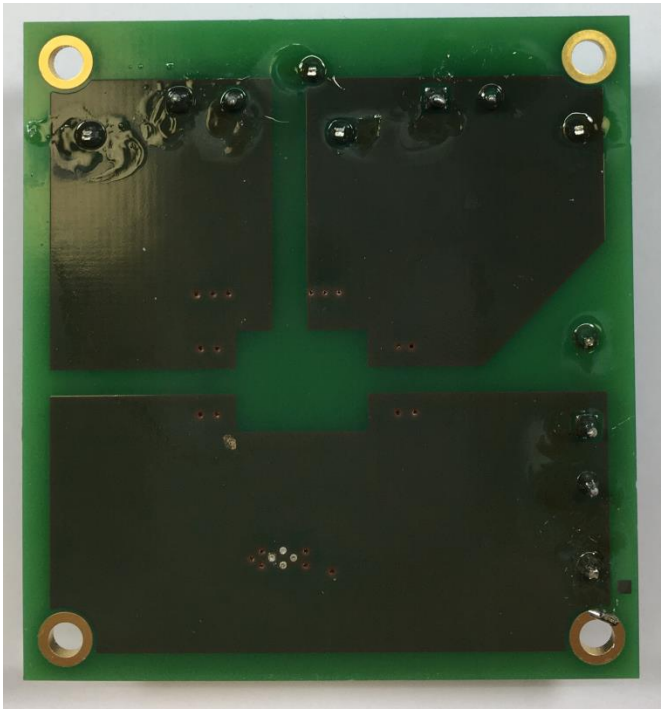
Test Report: PMP30750

3.5-W Automotive Dual Output PSR Flyback Regulator Reference Design

Description

This reference design showcases a dual output primary-side regulated flyback converter, which covers an input voltage range of 8.0 V to 36 V. The output voltage of the two isolated outputs is 17.5V each with a maximum load current of 100 mA.





1 Test Prerequisites

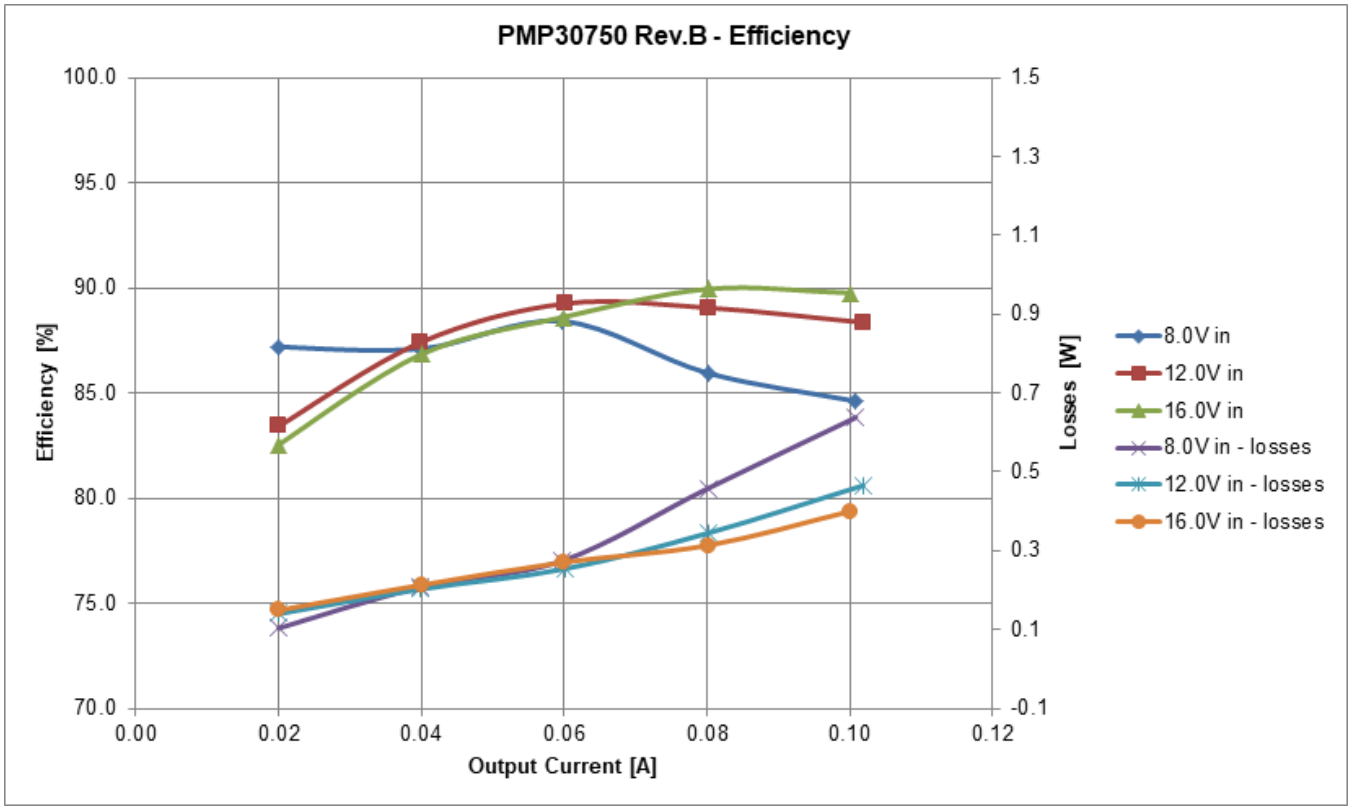
1.1 Voltage and Current Requirements

Table 1. Voltage and Current Requirements

PARAMETER	SPECIFICATIONS
VIN	8-16V, 12V nom., 36V peak
VOUT1	17.5V @ 100mA
VOUT2	17.5V @ 100mA
FSW	12-350kHz

2 Testing and Results

2.1 Efficiency Graphs



Efficiency at 8.0V, 12.0V and 16.0V in

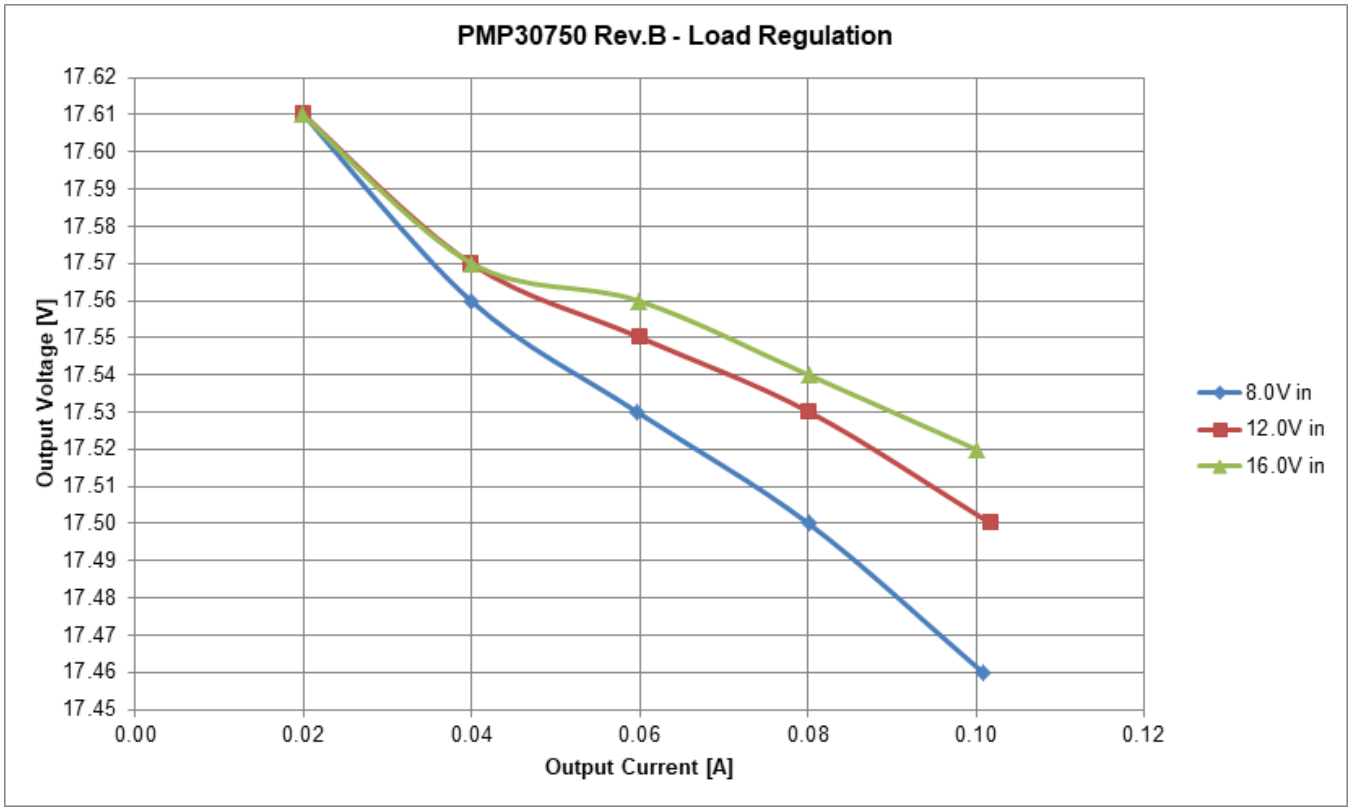
2.2 Efficiency Data

Input			Output 1			Output 2				
Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]	Losses [W]	Efficiency [%]
8.052	0.515	4.147	17.460	0.101	1.760	17.470	0.100	1.749	0.638	84.6
8.034	0.406	3.262	17.500	0.080	1.402	17.500	0.080	1.402	0.458	85.9
8.038	0.295	2.371	17.530	0.060	1.047	17.530	0.060	1.050	0.275	88.4
8.026	0.201	1.613	17.560	0.040	0.701	17.570	0.040	0.705	0.208	87.1
8.021	0.101	0.810	17.610	0.020	0.352	17.620	0.020	0.354	0.104	87.2

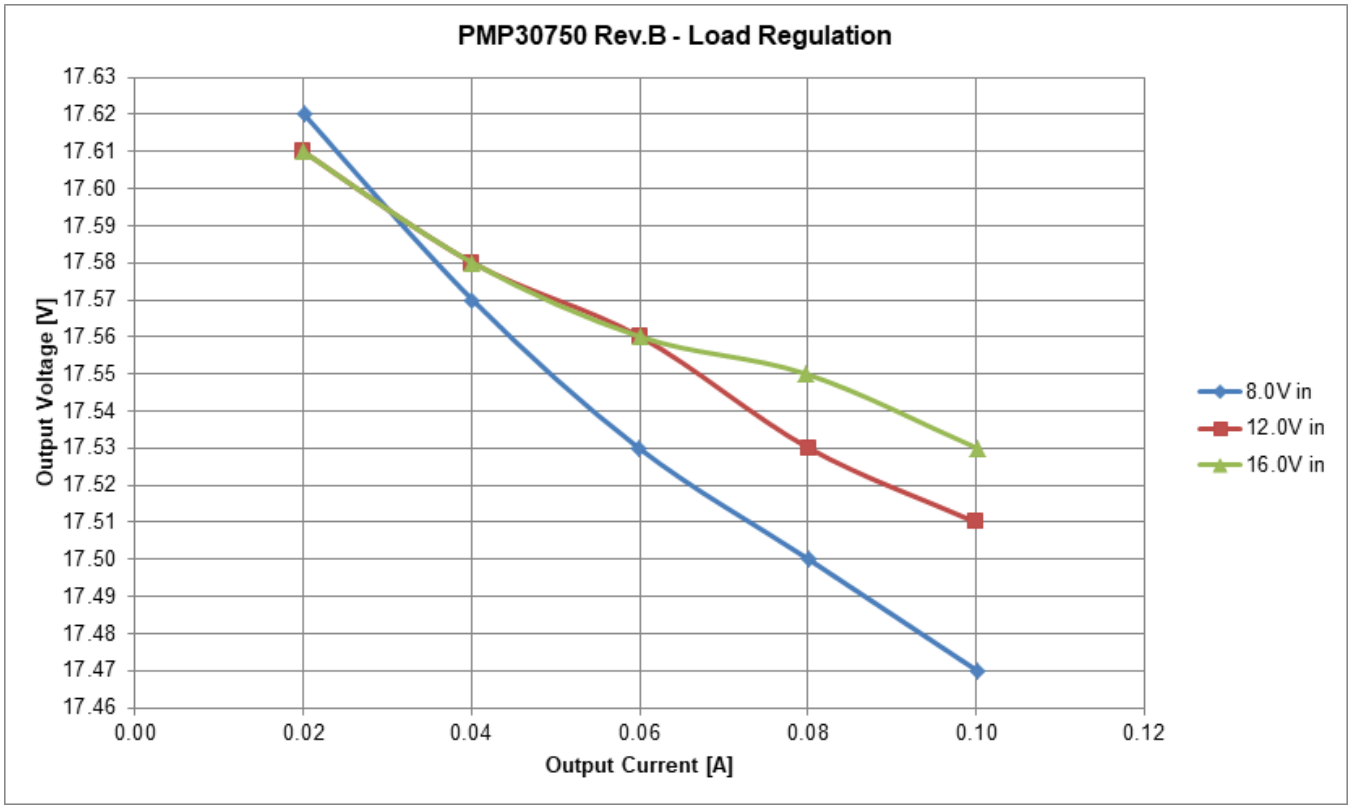
Input			Output 1			Output 2				
Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]	Losses [W]	Efficiency [%]
12.031	0.332	3.998	17.500	0.102	1.782	17.510	0.100	1.751	0.465	88.4
12.039	0.262	3.155	17.530	0.080	1.406	17.530	0.080	1.404	0.345	89.1
12.056	0.196	2.364	17.550	0.060	1.055	17.560	0.060	1.055	0.254	89.3
12.012	0.134	1.608	17.570	0.040	0.701	17.580	0.040	0.705	0.202	87.4
12.024	0.070	0.844	17.610	0.020	0.352	17.610	0.020	0.352	0.140	83.4

Input			Output 1			Output 2				
Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]	Voltage [V]	Current [A]	Power [W]	Losses [W]	Efficiency [%]
15.998	0.244	3.907	17.520	0.100	1.752	17.530	0.100	1.755	0.400	89.8
16.011	0.195	3.119	17.540	0.080	1.405	17.550	0.080	1.400	0.313	89.9
16.012	0.148	2.376	17.560	0.060	1.050	17.560	0.060	1.055	0.271	88.6
16.033	0.101	1.621	17.570	0.040	0.703	17.580	0.040	0.705	0.213	86.8
16.034	0.053	0.851	17.610	0.020	0.350	17.610	0.020	0.352	0.149	82.5

2.3 Load Regulation

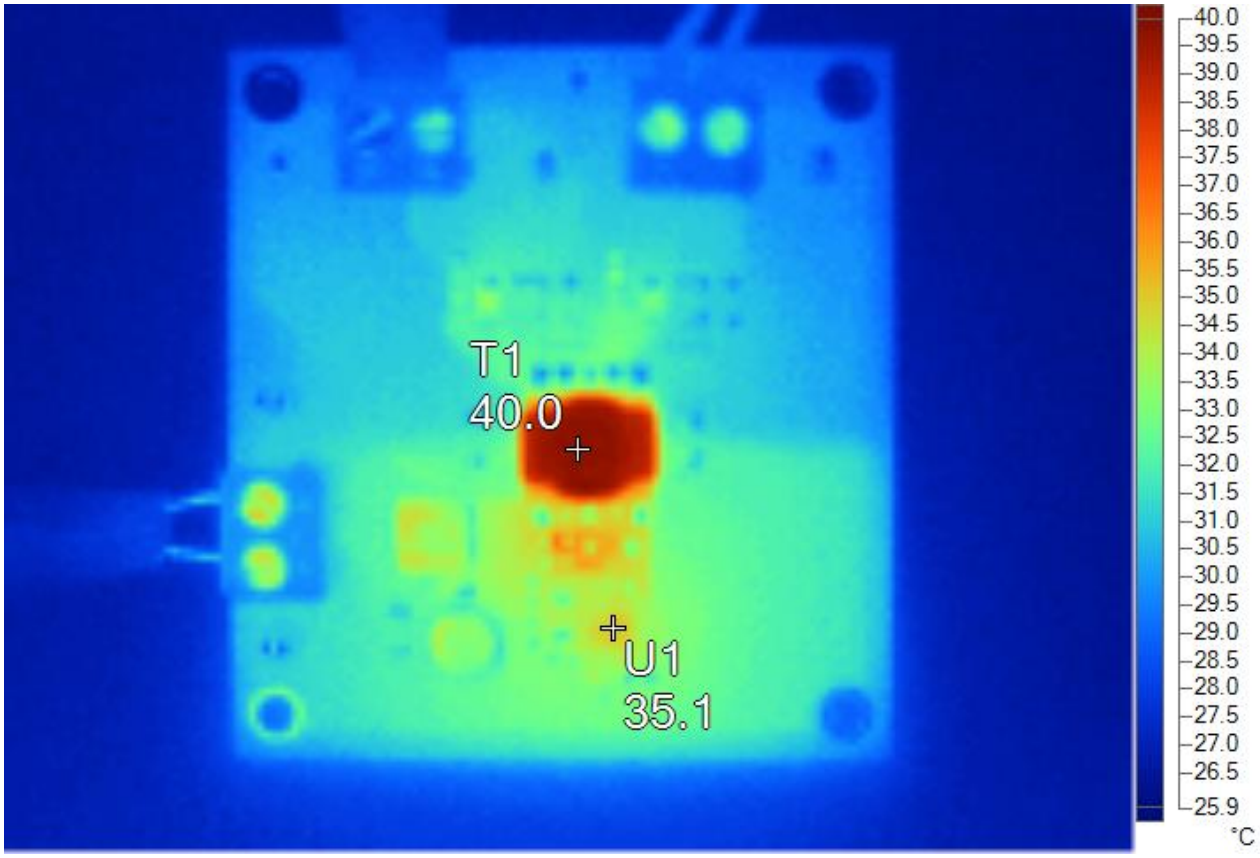


Load regulation of output 1 at 8.0V, 12.0V and 16.0V in

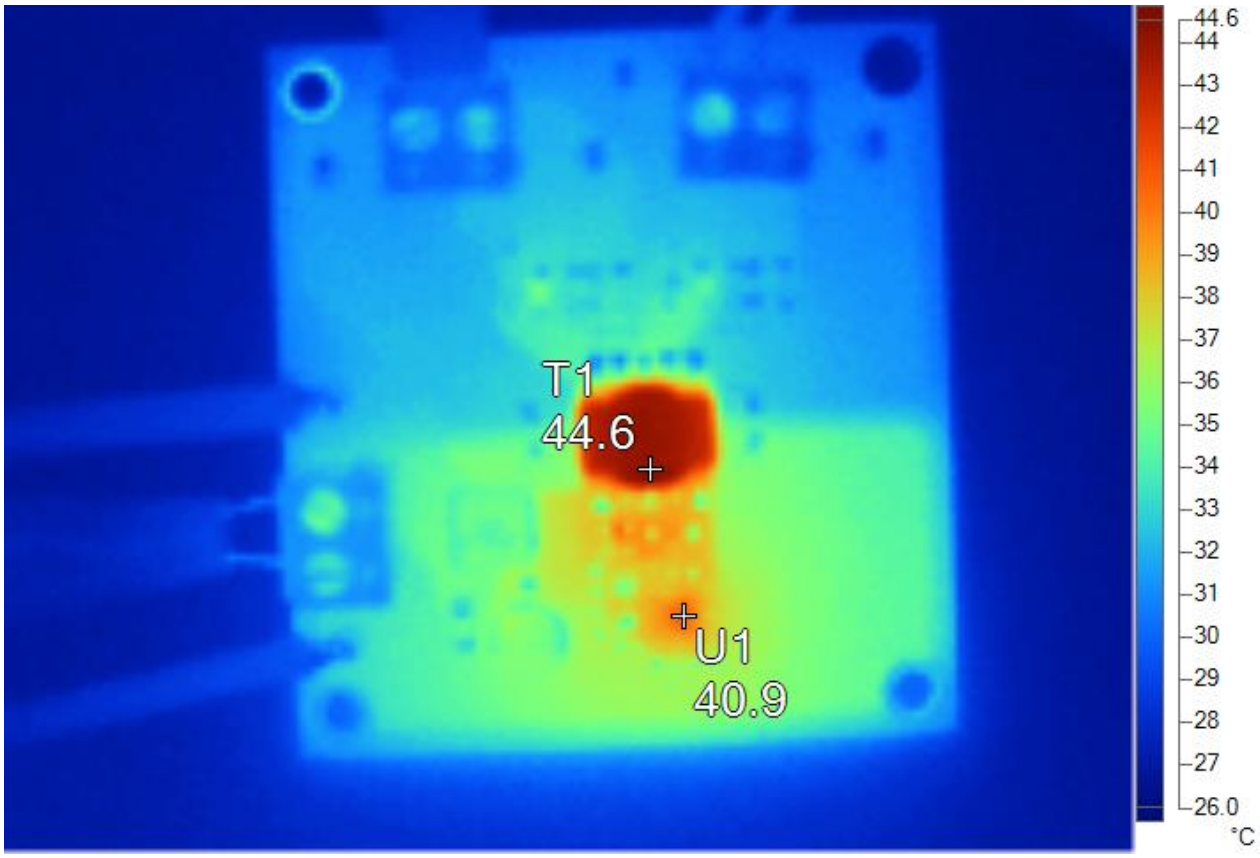


Load regulation of output 2 at 8.0V, 12.0V and 16.0V in

Thermal Images



Thermal image of the PCB's top side at 12.0V in and 0.1A load current on both outputs.



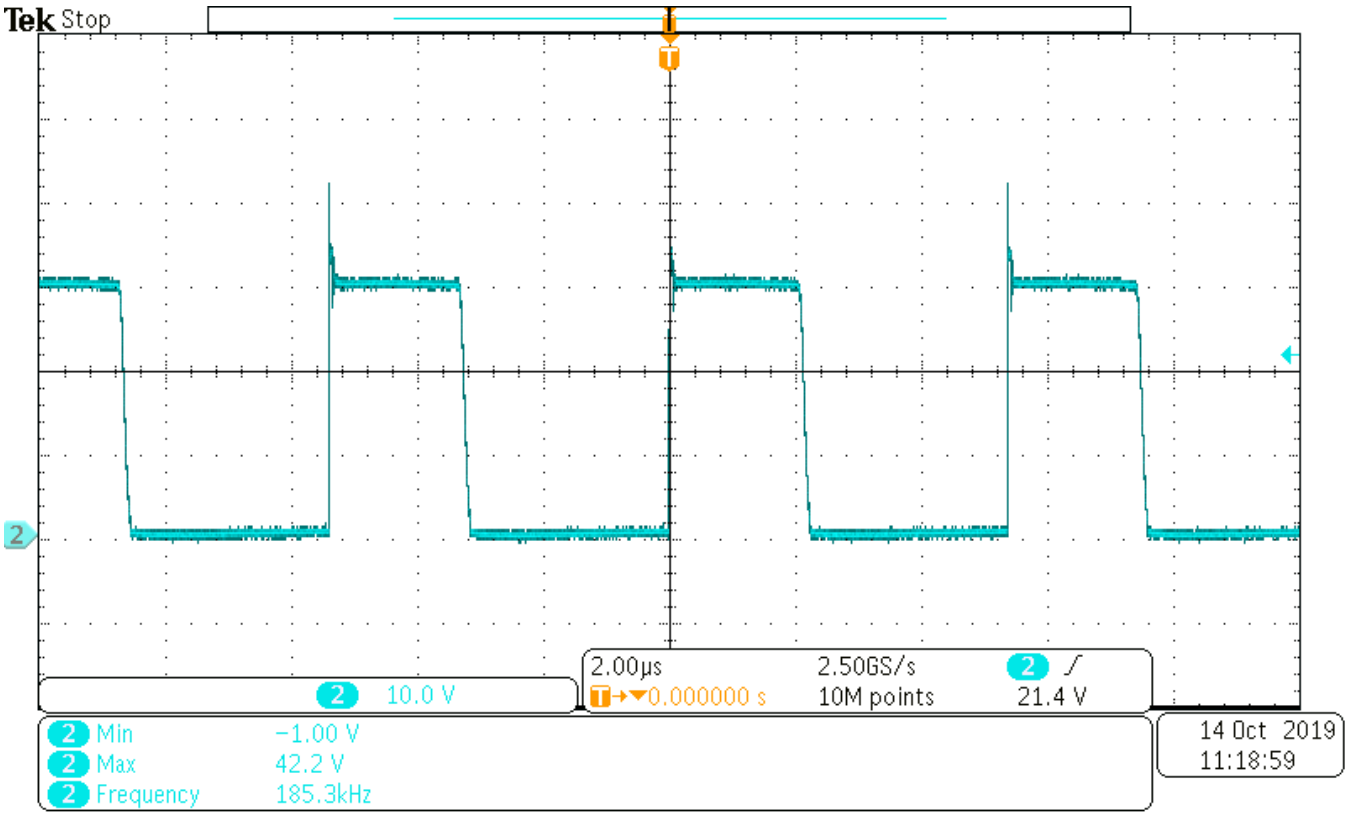
Thermal image of the PCB's top side at 8.0V in and 0.1A load current on both outputs.

2.4 Dimensions

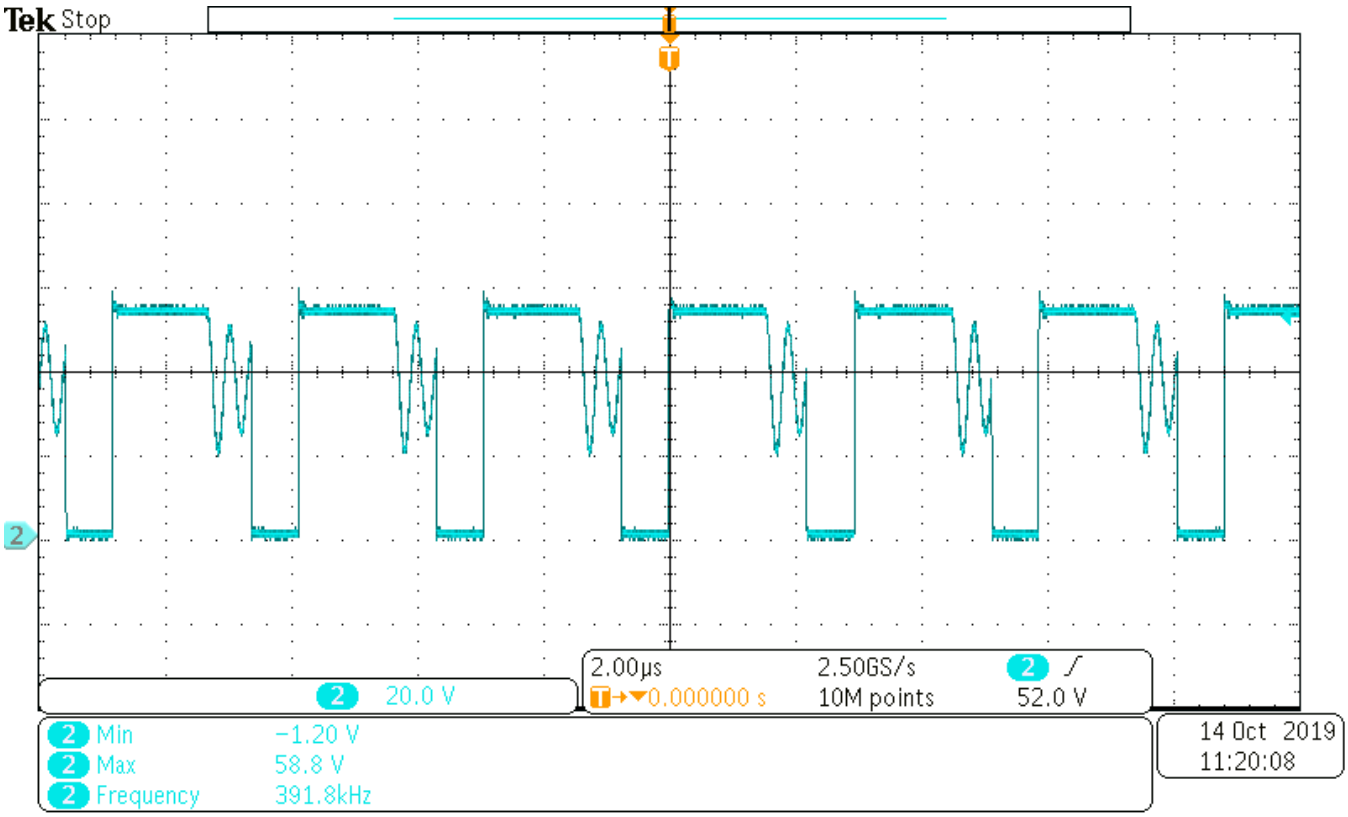
PCB: 55.9 mm x 60.1 mm

3 Waveforms

3.1 Switching

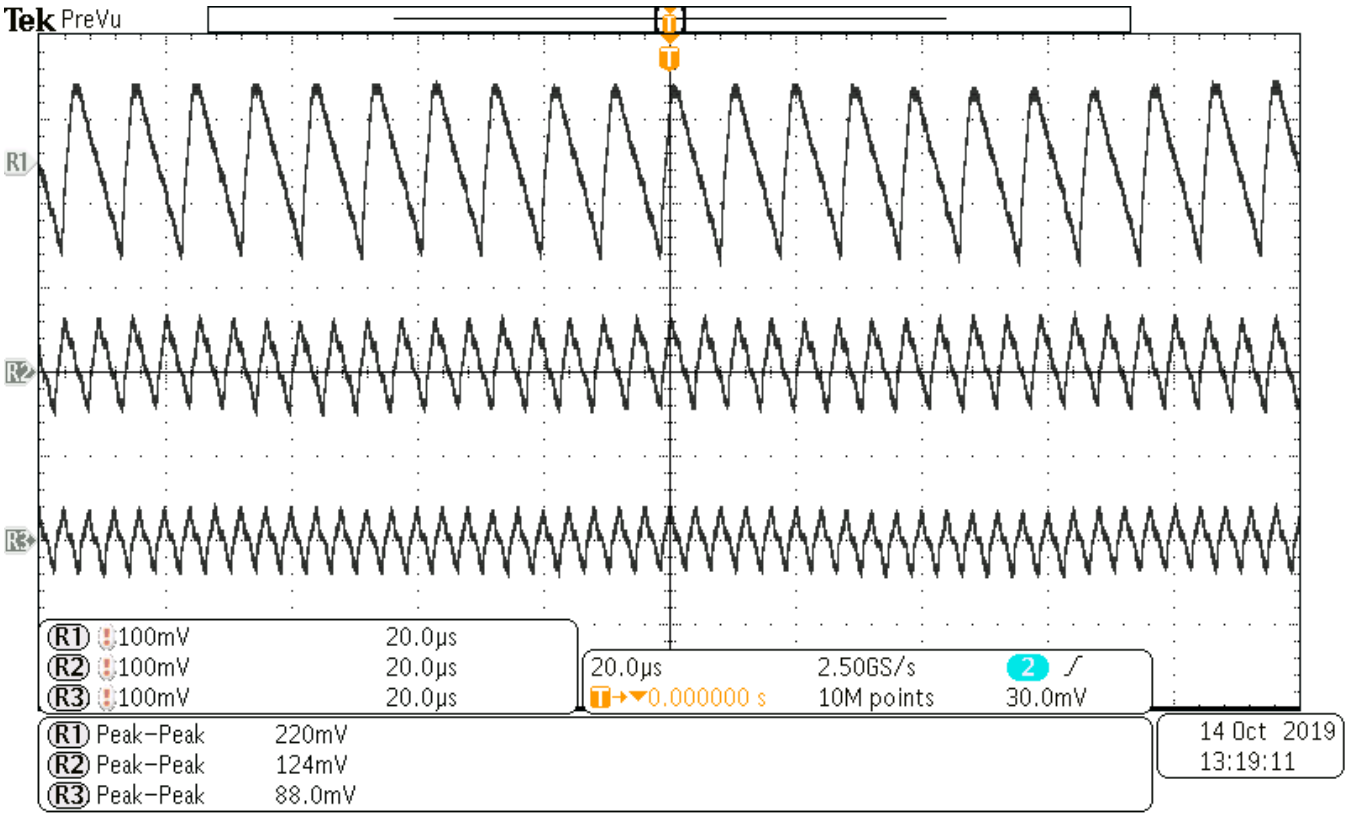


- CH2: Switching node at 12.0V in and 0.1A load current on both outputs [scale: 10.0V/div, 2.0us/div]

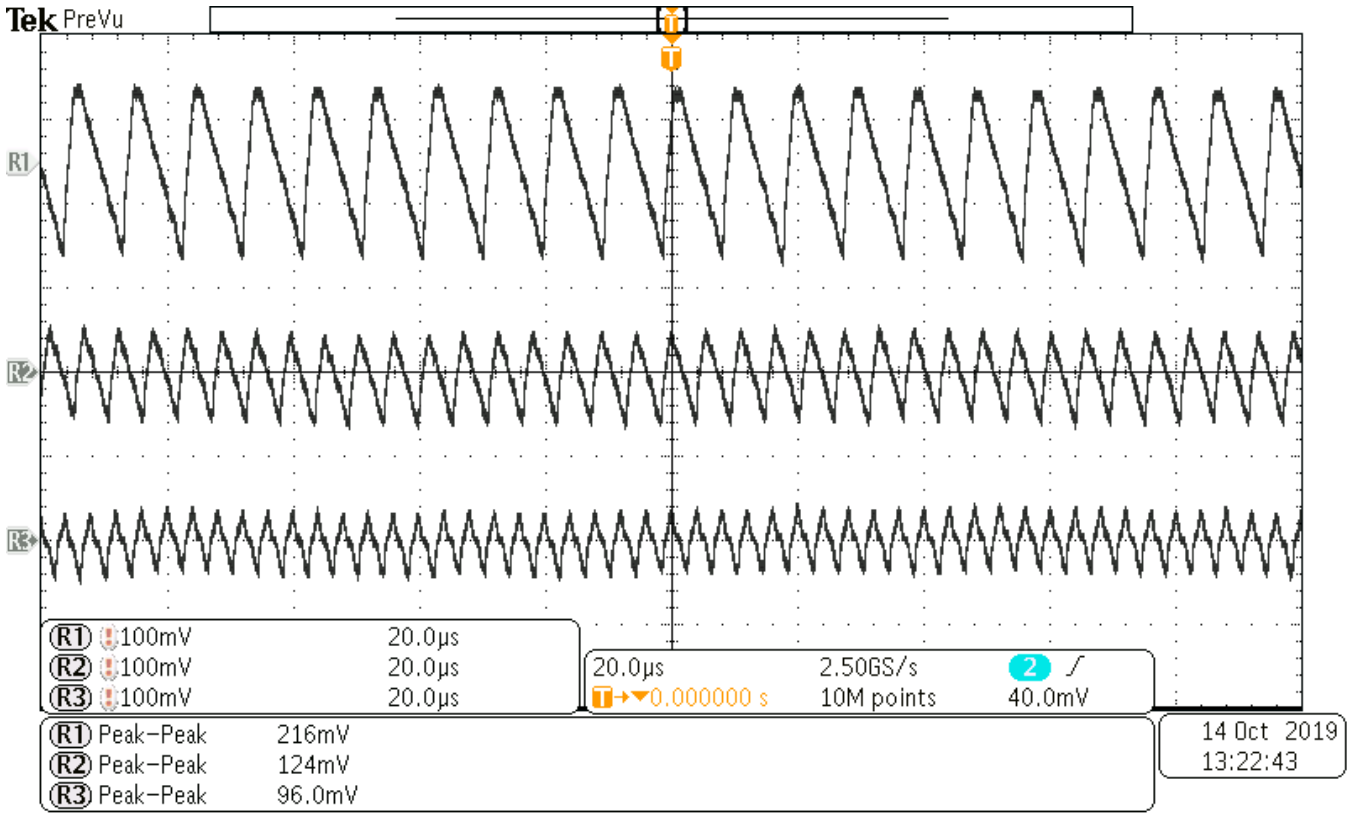


- CH2: Switching node at 36.0V in and 0.1A load current on both outputs [scale: 20.0V/div, 2.0us/div]

3.2 Output Voltage Ripple

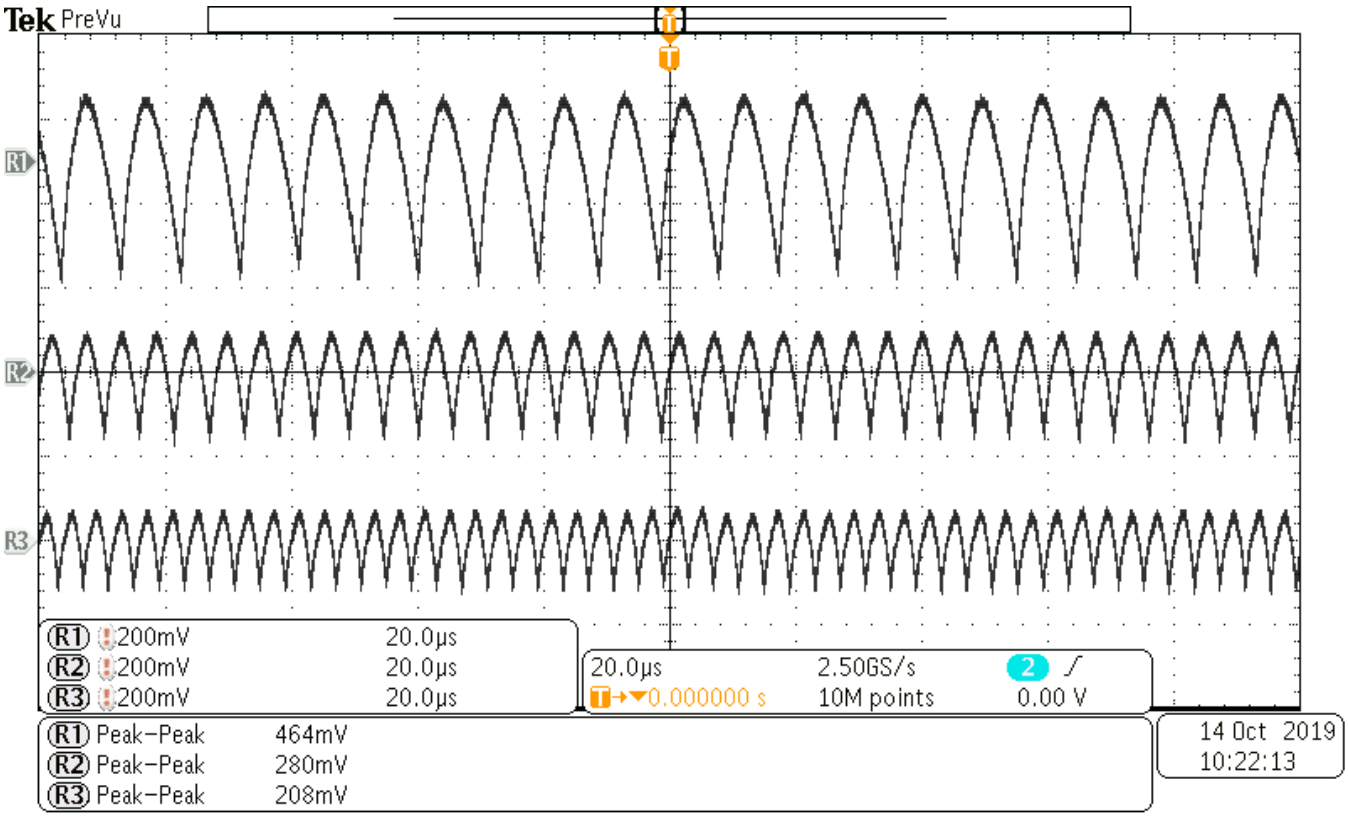


- R1: AC-coupled output voltage 1 at 8.0V in and 0.1A load current on both outputs [scale: 100mV/div, 20us/div]
- R2: AC-coupled output voltage 1 at 12.0V in and 0.1A load current on both outputs [scale: 100mV/div, 20us/div]
- R3: AC-coupled output voltage 1 at 16.0V in and 0.1A load current on both outputs [scale: 100mV/div, 20us/div]



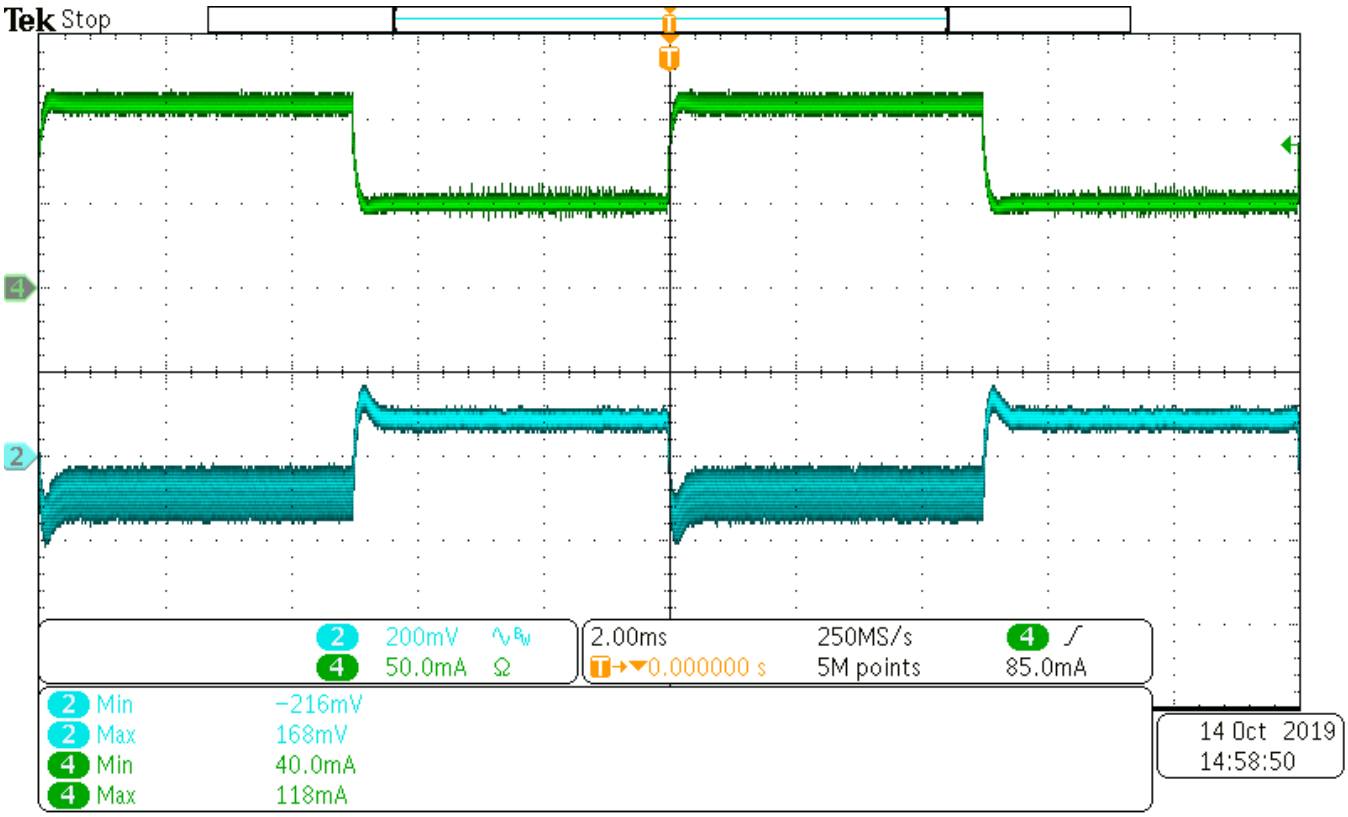
- R1: AC-coupled output voltage 2 at 8.0V in and 0.1A load current on both outputs [scale: 100mV/div, 20us/div]
- R2: AC-coupled output voltage 2 at 12.0V in and 0.1A load current on both outputs [scale: 100mV/div, 20us/div]
- R3: AC-coupled output voltage 2 at 16.0V in and 0.1A load current on both outputs [scale: 100mV/div, 20us/div]

3.3 Input Voltage Ripple



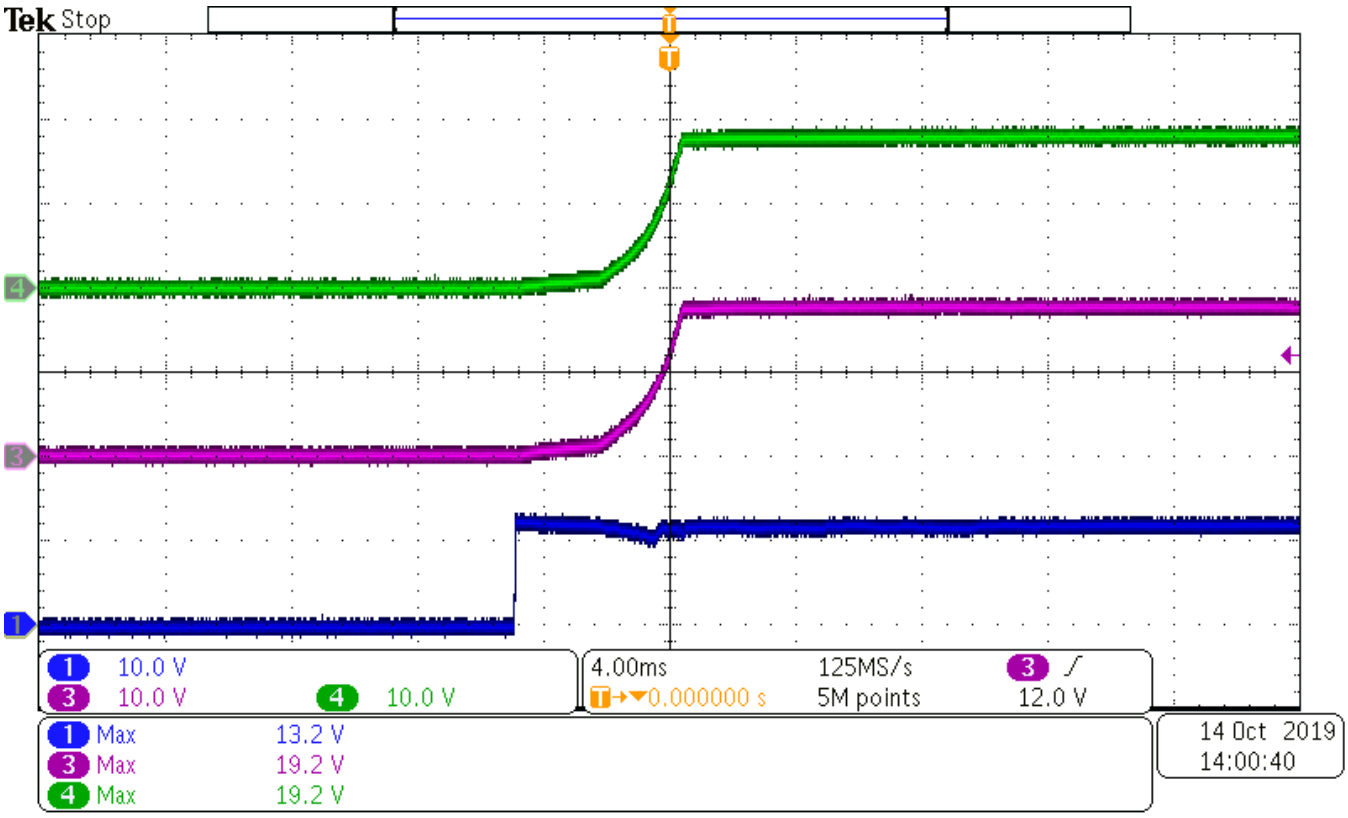
- R1: AC-coupled input voltage at 8.0V in and 0.1A load current on both outputs [scale: 200mV/div, 20us/div]
- R2: AC-coupled input voltage at 12.0V in and 0.1A load current on both outputs [scale: 200mV/div, 20us/div]
- R3: AC-coupled input voltage at 16.0V in and 0.1A load current on both outputs [scale: 200mV/div, 20us/div]

3.4 Load Transients



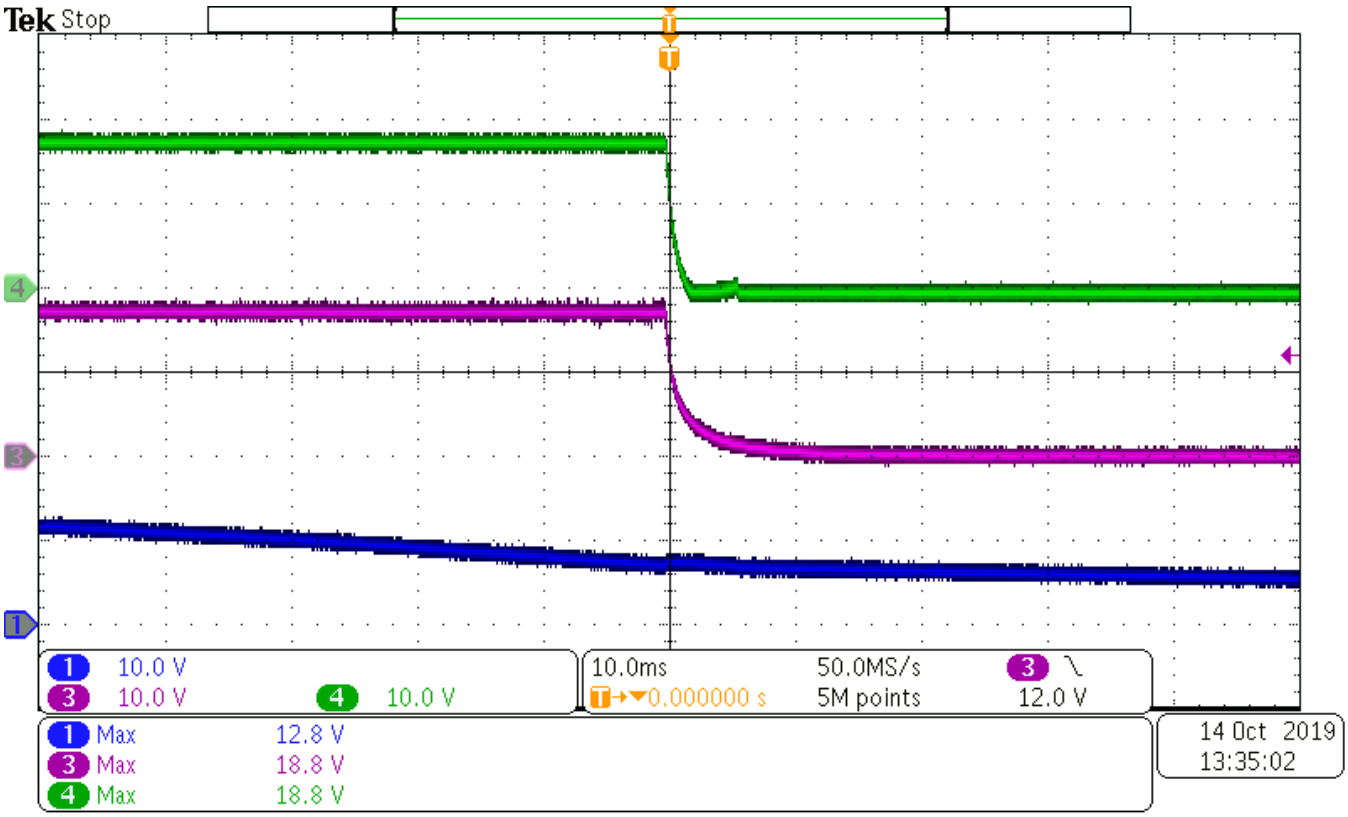
- CH2: AC-coupled output voltage 2 at 12.0V in and 0.1A load current on output 1, bw limited (20MHz) [scale: 200mV/div, 2ms/div]
- CH4: Load transient from 0.05A to 0.1A on output 2 at 12.0V in and 0.1A load current on output 1 [scale: 50mA/div, 2ms/div]

3.5 Start-up Sequence



- CH1: Input voltage at 12.0V in and no load on both outputs [scale: 10.0V/div, 4ms/div]
- CH3: Output voltage 1 at 12.0V in and no load on both outputs [scale: 10.0V/div, 4ms/div]
- CH4: Output current 2 at 12.0V in and no load on both outputs [scale: 10.0V/div, 4ms/div]

3.6 Undervoltage Protection



- CH1: Input voltage at 12.0V in and 0.1A load current on both outputs [scale: 10.0V/div, 10ms/div]
- CH3: Output voltage 1 at 12.0V in and 0.1A load current on both outputs [scale: 10.0V/div, 10ms/div]
- CH4: Output current 2 at 12.0V in and 0.1A load current on both outputs [scale: 10.0V/div, 10ms/div]

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